TOOL & DIE MAKER

NSQF LEVEL – 4.5

SECTOR- CAPITAL GOODS & MANUFACTURING

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

TOOL & DIE MAKER

Applicable for "Tool & Die Maker (Press tool, Jigs & Fixtures)" and "Tool & Die Maker (Dies & Moulds)" Trades

(Engineering Trade)

SECTOR –CAPITAL GOODS & MANUFACTURING

(Revised in 2024)

Version 2.1

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Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI) at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. “Tool & Die Maker” CITS trade is applicable for Instructors of “Tool & Die Maker (Press tool, Jigs & Fixtures)” and “Tool & Die Making (Dies &Moulds)” CTS Trades.

The main objective of Crafts Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2. 1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portalhttp://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2. 2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	480
	Professional Knowledge (Trade Theory)	270
2.	**Training Methodology**	
	TM Practical	270
	TM Theory	180
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

3	On the Job Training (OJT)/ Group Project	150
4	Optional Courses	240

Trainees can also opt for optional courses of 240 hours duration.

2. 3 PROGRESSION PATHWAYS

- Can join as a Technical Instructor in a Vocational Training Institute/ Technical Institute.
- Can join as a supervisor in Industries.

2. 4 ASSESSMENT& CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment

criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2. 4. 1 PASS CRITERIA

Allotment of Marks among the subjects for Examination:

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

2. 4. 2 ASSESSMENT GUIDELINES

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. While assessing; the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until

forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weight age in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional* guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little* guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A high level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**Tool & Die Maker -CITS**
Trade Code	DGT/4035
Reference NCO 2015	2356. 0100, 7222. 0500, 7222. 0200, 7222. 0300, 7223. 0200, 3115. 1302
NOS Covered	CSC/N9511, CSC/N9512, CSC/N9513, CSC/N9514, CSC/N9515, CSC/N9516, CSC/N9517, CSC/N9518, CSC/N9519, CSC/N9520, CSC/N9521, CSC/N9522, CSC/N9523, CSC/N9524, CSC/N9525, CSC/N9526, CSC/N9527, CSC/N9528, CSC/N9529, CSC/N9530, CSC/N9531, CSC/N9532, CSC/N9533, CSC/N9534, CSC/N9535, CSC/N9536, ASC/N9410, ASC/N9411
NSQF Level	Level-4.5
Duration of Craftsmen Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in Mechanical/ Production/ Mechatronics Engineering from AICTE/ UGC recognized Engineering College/ University OR 03 years Diploma in Mechanical/ Production/ Mechatronics Engineering/ Tool and Die making after class 10th from AICTE/ recognized board of technical education. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR OR 10th class with 2-year NTC/NAC passed in the trade of Tool & Die Maker or related trades.
Minimum Age	16 years as on first day of academic session.
Space Norms	120 sq. m
Power Norms	25 KW
Instructors Qualification for	
1. Tool & Die Maker - CITS Trade	B.Voc/Degree in Mechanical/ Production/ Mechatronics Engineering from AICTE/UGCrecognized University with two years' experience in relevant field. OR 03 years Diploma in Mechanical/ Production/ Mechatronics Engineering/ Tool and Die making from AICTE/recognized Board / University with five years' experience in relevant field. OR Ex-serviceman from Indian Armed forces with 15 years of service in related filed as per equivalency through DGR. Candidate should have undergone methods of instruction course or minimum 02 years of experience in technical training institute of Indian armed forces. OR NTC/ NAC passed in Tool & Die Maker (Press tool and Jigs &

	Fixtures)/ Tool & Die Maker (Dies & Moulds) trade with seven years' experience in relevant field. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC) in ''Tool & Die Maker'' trade, in any of the variants under DGT.
2. Workshop Calculation &Science	B. Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years' experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years' experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B. Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years' experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT
4. Training Methodology	B. Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years' experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years' experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years' experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants

	under DGT / B. Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; Instructs students in ITIs/Vocational Training Institutes in respective trades. Imparts theoretical instructions for the use of tools, mechanical drawings, blueprint reading and related subjects. Demonstrates processes and operations in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment & tools in stores.

Die Maker; Die Fitter; Press Tool Fitter makes metal dies to prescribed dimension for punching, cutting, forging and forming of metal or synthetic components for mass production. Studies drawing and specifications of dies to be made. Selects required type of metal or rough cast metal block. Machines or grinds one surface and marks it with template or otherwise to indicate dimensions and other working details. Cuts shapes, drill holes and mills metal according to marking on various machines. Checks dimensions while working with gauges and other measuring tools. Finishes male die (punch) by filing to required dimension and fits female to it. Files cutting angle and clearance accurately in female die and checks for sizes. Drills holes and cuts thread in female die for driving guide pin and fitting guide plates. Gets male and female dies tempered and grinds them to finish ensuring correct shear, cutting angle, clearances, etc. Sets finished dies in press and cuts or forms some trial pieces to ensure accuracy and correct production. May shape female die block to required angle for fitting it in bolster. May repair used dies and grind them to desired finish. May operate lathe, milling and shaping machines and harden and temper dies.

Tool Maker; makes cutting and press tools, gauges, simple jigs, fixtures, etc. mainly for use in machines. Studies drawings, samples and other specifications of tool orgauge to be made. Selects required type of metal or alloy and marks it for various operations, using Vernier height gauges, sine plate, vee blocks, etc. Cuts, files, grinds, scrapes or otherwise shapes metal to specified dimensions frequently checking it while working with measuring instruments such as micrometre, Vernier caliper, gauges, face plate etc. as necessary. Anneals, shapes, hardens and temper scutting tools ensuring correct cutting angles, clearances, etc. according to standard or prescribed specifications. Assembles part, finishes object. Check saccuracy with precision measuring instruments and shadow graph if necessary to ensure desired performance. Calibrates and adjusts tools and gauges where required and maintains them in good working order. Guides brazing of tips to stalks and finishes them to make tip tools. Is designated as Gauge Maker if engaged in making or reconditioning gauges. May repair and recondition tools for further use. May design tools, jigs and fixtures and braze and weld metal parts.

Jig and Fixture Maker; makes and repairs jigs and fixtures (device for holding metal and guiding cutting tools) for mass production work. Studies drawing and checks dimensions and other specifications of sample to calculate working details. Collects material, gets surfaces finished by filing or machining and marks them off. Makes different parts of required jig or fixture by cutting, filing, machining, grinding, scraping, drilling, screwing, etc. and finishes

them to required dimensions. Hardens and tempers necessary parts or gets them done ensuring that they do not get deformed. Assembles parts in proper sequence, fits hardened bushes or parts where specified to guide cutting tools and checks easy fixing and removing of part to be machined to ensure operational efficiency of jig or fixture made. Checks fitting of jig and fixture at each stage while assembling to conform to specifications. Tests completed jig or fixture by trial operations to ensure operational efficiency and accuracy in production work. May make adaptors, pullers etc. for specific purposes. May machine and grind jig and fixture parts.

Tool Setter, Press; sets press tools (die and punch) in power and hand press for manufacture of sheet metal products. Examines sample or studies drawings and specifications of item for production. Selects appropriate pair of die and punch and examines them for sharpness, cutting angle, clearance, etc. Fits punch in punch holder of machine and securely screws it in position. Places die on machine table and lowers punch to fit in die. Adjusts position of die in relation to punch. Clamps die securely on machine table with holders, plates, bolts and nuts and manually operate punch few times to ensure that it passes clearly through die set. Starts machine and feeds metal to cut or form trial pieces. Examines them for correctness in all respects, resets die if necessary, and hands press over to operator for production work. May grind press tools on surface grinder. May fit guide pin in die to avoid wastage of material. May fit die in bolster (holding device) before setting. May supervise operators.

Tool Room Supervisor; oversees operations of different machine tools performed both manually and through automatic/CNC machines/robots. His role primarily involves supervising all kinds of machining and in-line inspection activities for quality verification. He is also responsible for the various tool assembly processes.

NCO Code2015:

I. 2356. 0100 – Manual Training Teacher/Craft Instructor
II. 7222. 0500 – Die Maker
III. 7222. 0200 – Tool Maker
IV. 7222. 0300 – Jig and Fixture Marker
V. 7223. 0200 – Tool Setter, Press
VI. 3115. 1302– Tool Room Supervisor

Reference NOS:

I. CSC/N9511
II. CSC/N9512
III. CSC/N9513
IV. CSC/N9514
V. CSC/N9515
VI. CSC/N9516
VII. CSC/N9517
VIII. CSC/N9518
IX. CSC/N9519
X. CSC/N9520
XI. CSC/N9521
XII. CSC/N9522
XIII. CSC/N9523
XIV. CSC/N9524
XV. CSC/N9525
XVI. CSC/N9526
XVII. CSC/N9527
XVIII. CSC/N9528
XIX. CSC/N9529
XX. CSC/N9530
XXI. CSC/N9531
XXII. CSC/N9532
XXIII. CSC/N9533
XXIV. CSC/N9534
XXV. CSC/N9535
XXVI. CSC/N9536
XXVII. ASC/N9410
XXVIII. ASC/N9411

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5. 1LEARNING OUTCOMES (TRADE TECHNOLOGY)

1. Demonstrate & comply with safe working practices, environment regulation and housekeeping. (NOS: CSC/N9511)
2. Demonstrate and produce components by different operations and check accuracy using appropriate measuring instruments. [Different Operations – Drilling, reaming, Tapping, Dieing; Appropriate Measuring Instruments – Vernier caliper, Screw Gauge, Micrometer] (NOS: CSC/N9512)
3. Explain preparation of different cutting tools to produce jobs to appropriate accuracy by performing different turning operations. [Different cutting tool – V tool, side cutting (LH & RH), parting, thread cutting.] (NOS: CSC/N9513)
4. Demonstrate and perform different turning operations. [Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0. 06mm, Different turning operation – facing, Plain / Parallel Turning, Step Turning, parting, chamfering, U –cut/ grooving, drilling, boring (counter & stepped), Reaming, internal recess, knurling.] (NOS: CSC/N9514)
5. Demonstrate Setting of different machining parameters to produce taper/angular components and ensure proper assembly of the components. [Different component of machine: form tool, Compound slide, tail stock offset; Different machine parameters – feed, speed, depth of cut] (NOS: CSC/N9515)
6. Demonstrate and produce threaded components and check for proper assembly of the components with an accuracy of ± 0. 05 mm. [Different threads viz., metric/ BSW/ Square] (NOS: CSC/N9516)
7. Exhibit different machining parameters and cutters to produce job by performing different milling operation and indexing. [Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, stepped, angular, dovetail, T-slot, contour, gear milling] (NOS: CSC/N9517)
8. Demonstrate and Produce components of high accuracy by surface and cylindrical grinding operation. [accuracy of +/- 0. 02 mm] (NOS: CSC/N9518)
9. Exhibit sharpening of different cutter or multipoint cutting tool. [Different cutters – end mill cutter, side & face milling cutter, single angle cutter, Reamer] (NOS: CSC/N9519)
10. Develop and explain drawing of press tool components and solid modeling of mould using CAD. (NOS: CSC/N9520)
11. Demonstrate and perform heat treatment of work piece/job & measure hardness, stress, strain, elongation, and modulus of given metals. (NOS: CSC/N9521)
12. Construct and explain circuit of electro-pneumatics and hydraulics observing standard operating procedure & safety aspect. (NOS: CSC/N0316, CSC/N9522)

13. Demonstrate CNC turning centre/ CNC machining centre and produce components as per drawing by preparing part programme. (NOS: CSC/N9523)
14. Produce components using Electric Discharge machine (EDM) and Wire EDM as per drawing by preparing part programme with accuracy of ± 0. 02mm. (NOS: CSC/N9524)
15. Demonstrate 2D & 3D machining with CAM software. (NOS: CSC/N9525)
16. Demonstrate manufacturing and assembling of drill Jig and check for correctness of produced component. (NOS: CSC/N9526)
17. Demonstrate manufacturing and assembling of Fixture (milling, turning and grinding) & test dimensional accuracy. (NOS: CSC/N9527)
18. Construct and assemble different Press tools viz. Piercing &Blanking tool, Progressive tool, Compound Tool and verify the component. (NOS: CSC/N9528)
19. Construct and assemble draw tool (single stage) and verify the component. (NOS: CSC/N9529)
20. Construct and assemble "V" bending tool & test the component. (NOS: CSC/N9530)
21. Plan, demonstrate and perform simple repair, overhauling of different Jig, fixture and press tool and check for functionality. (NOS: CSC/N9531)
22. Construct a Hand Injection Mould and try out the mould assembly. (NOS: CSC/N9532)
23. Explain and construct two cavity injection mould and try out the mould assembly. (NOS: CSC/N9533)
24. Illustrate and explain function of basic electrical circuit and sensors. (NOS: CSC/N9534)
25. Construct and explain single cavity mould (Compression mould/ plunger type transfer mould). (NOS: CSC/N9535)
26. Illustrate and explain isometric drawing and construct two cavity moulds with side core. (NOS:CSC/N9536)
27. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.
    (NOS: ASC/N9411)

6. COURSE CONTENT

SYLLABUS FOR TOOL & DIE MAKER - CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 10 Hrs Theory 05 Hrs	Demonstrate & comply with safe working practices, environment regulation and housekeeping. (NOS: CSC/N9511)	1. **Occupational Safety & Health** **Importance of housekeeping & good shop floor practices.** • Recognize Health, Safety and Environment guidelines, legislations & regulations as applicable. • Apply Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. • Demonstrate basic safety matters, Personal protective Equipments (PPE): -Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. 2. Check preventive measures for electrical accidents & steps to be taken in such accidents. 3. Demonstrate use of Fire extinguishers. 4. **Basic Life support training:** Be able to perform DRSABCD: D: Check for Danger R: Check for a Response S: Send for help A: Open the Airway B: Check for normal Breathing C: Perform CPR (Cardio	Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e. g.; power failure, fire, and system failure **Introduction to 5S** concept & its application. Importance of 5S implementation throughout CITS course-workplace cleaning, machine cleaning, signage, proper storage of equipment etc. **Basic Life support (BLS): -** Basic Life Support (BLS) techniques for drowning, choking, electrocution, neck and spinal injury, including CPR (cardiopulmonary resuscitation).

		Pulmonary Resuscitation) D: Attach Defibrillator / Monitor as soon as available.	
Practical 10 Hrs Theory 05 Hrs	Demonstrate and Produce components by different operations and check accuracy using appropriate measuring instruments. *[Different Operations – Drilling, reaming, Tapping, Dieing; Appropriate Measuring Instruments – Vernier caliper, Screw Gauge, Micrometer]* (NOS: CSC/N951)	5. Demonstrate Marking of job with appropriate marking tool as per drawing. 6. Demonstrate and practice on Drill through holes. 7. Demonstrate and practice Counter sinking, counter boring spot facing. 8. Demonstrate and perform Drill on PCD with the accuracy of 0. 06 mm. 9. Demonstrate and perform reaming of holes. 10. Demonstrate and perform tapping on drill hole. 11. Demonstrate and perform dieing on a small rod.	Engineering materials-Ferrous and non-ferrous material, properties of material. Limits, fits & Tolerance terminology as per Latest IS 919 Combination of hole and shaft for a particular fit, Geometrical accuracy and tolerances by machining process. Table for tolerance zones and limits.
Practical 10 Hrs Theory 05 Hrs	Explain preparation of different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. *[Different cutting tool – V tool, side cutting (LH & RH), parting, thread cutting.]* (NOS:CSC/N951)	12. Demonstrate and perform on grinding single point V cutting tool by using pedestal grinder. 13. Demonstrate and perform on grinding single point Side cutting tool (LH& RH) by using pedestal grinder. 14. Demonstrate and perform on grinding parting tool by using pedestal grinder. 15. Demonstrate and perform on grinding single point thread cutting tool by using pedestal grinder.	Pedestal Grinding Machine and classification, constructional features. Grinding Wheel –types& shapes – Specification-size. Cutting tool Geometry and their function.
Practical 10 Hrs Theory	Demonstrate and perform different turning	16. Demonstrate and perform Lathe-External operation – (Viz. *Plain turning, facing,*	Lathe–types-classification – constructional features, accessories, operation,

05 Hrs	operations. *[Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0. 06mm, Different turning operation – facing, Plain / Parallel Turning, Step Turning, parting, chamfering, U – cut/ grooving, drilling, boring (counter & stepped), Reaming, internal recess, knurling* (NOS: CSC/N9514)	*Parallel Turning, Step Turning, parting, chamfering, U -cut, grooving, drilling, boring (counter & stepped), Reaming, internal recess, knurling*).	application and specification. Job holding devices - chucks, collets, bar feeding mechanism. Tool holding devices - roller steady box, knee tool holder & self-opening die. Different cutting tool materials. Cutting tool Geometry and their function Tool setting in correct center height - effects of rake & clearance angle.
Practical 10 Hrs Theory 05 Hrs	Demonstrate Setting of different machining parameters to produce taper/angular components and ensure proper assembly of the components. *[Different component of machine: form tool, Compound slide, tail stock offset; Different machine parameters –*	17. Demonstrate and perform taper turning 18. Demonstrate and perform Eccentric Turning.	Classification of Tapers, Standard tapers and their, uses. Different Taper turning methods, working principle and calculations. Coolant used in metal cutting and its applications Classification of lubricants-Types-Functions-Characteristics-Applications and its importance.

	feed, speed, depth of cut] (NOS: CSC/N9515)		
Practical 10 Hrs Theory 05 Hrs	Demonstrate and produce threaded components and check for proper assembly of the components with an accuracy of ± 0. 05 mm. *[Different threads viz. , metric/ BSW/ Square]* (NOS: CSC/N9516)	19. Demonstrate and perform thread cutting (external & Internal) in Lathe Machine - gear calculation, tool setting, arrangement in cutting and matching *[Different threads viz. , metric/ BSW/ Square]*.	Definition and calculation of Cutting speed, feed, depth of cut & machining time of lathe. Thread cutting - Different types, Gear Calculation, Tool Setting, Checking the thread. measurement of thread sections, Orthogonal and oblique cutting, cutting force, cutting power, Concept of chip formation, types of chips. Built-up edge formation.
Practical 30Hrs Theory 15Hrs	Exhibit different machining parameters and cutters to produce job by performing different milling operation and indexing. *[Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, stepped, angular, dovetail, T-slot, contour, gear milling]* (NOS: CSC/N9517)	20. Demonstrate operations and produce job employing plain milling, step milling, angular milling to an accuracy of ± 0. 04 mm. 21. Demonstrate and practice T-Slot Milling.	Milling machine– classification – constructional features, accessories, operation, application and specification. Milling processes- Peripheral milling, Up & Down milling, Different type of Milling operations - Face milling, End milling, Straddle milling, Plain milling, Side milling, Angular milling, Gang milling, End milling etc.
		22. Demonstrate and practice Dovetail (male &female) Milling. 23. Perform & monitor milling of Spur gear and Helical gear using form cutter.	Milling cutters- Types, nomenclature & uses. Cutting speed, feed, depth of cut & machining time calculations. Special milling attachments and their applications. Gear cutting methods- Gear tooth elements and related calculation. Different types of indexing methods and its calculations.
Practical 30Hrs	Demonstrate and	24. Demonstrate and practice	Surface grinding and

Theory 15Hrs	Produce components of high accuracy by surface and cylindrical grinding operation. *[accuracy of +/- 0. 02 mm]* (NOS: CSC/N9518)	Flat and inclined surface grinding. 25. Demonstrate and practice cylindrical grinding - external and internal –Straight and taper. 26. Demonstrate and practice dressing and balancing of Grinding wheel.	Cylindrical grinding machine parameters and grinding allowance-Geometrical accuracy and tolerance by machining process
Practical 10 Hrs Theory 05 Hrs	Exhibit sharpening of different cutter or multipoint cutting tool. *[Different cutters – end mill cutter, side & face milling cutter, single angle cutter, Reamer]* (NOS: CSC/N9519)	27. Demonstrate and practice Grinding of multi point cutting tool viz. cylindrical milling cutters, end milling cutter, side & face milling cutters on a tool & cutter grinder.	Description of angles in multi point cutting tool. Tool angles and its importance.
Practical 20Hrs Theory 10Hrs	Develop and explain drawing of press tool components and solid modeling of mould using CAD. (NOS: CSC/N9520)	28. Auto Cad Practice using simple drawing commands and co-ordinate systems. 29. Demonstrate using draw-modify commands. 30. Explain dimensioning using layers. 31. Demonstrate and practice designing and drawing of press tool components, solid modeling, Creating Template-Plotting-Printing.	Introduction to Auto Cad-Coordinate system-obsolete-polar –relative Familiarization with Draw-Modify Object snap tools and snap setting Dimensioning-layers-template and properties
Practical 10Hrs Theory 05Hrs	Demonstrate and perform heat treatment of work piece/ job & measure hardness, stress, strain, elongation,	32. Demonstrate and practice Heat treatment process such as annealing, normalizing, hardening, tempering, case hardening. 33. Demonstrate and practice testing of hardness and other properties of metals.	Heat treatment - purpose and its effect on the properties of metals. Change in the structure of steel during heating and cooling. Different processes of Heat Treatment - Annealing,

	modulus of given metals. (NOS: CSC/N9521)		normalizing, hardening and tempering, Case hardening, surface hardening, carburizing, nitriding, flame hardening and induction hardening. Material testing, hardness, tensile and compressive strength, crack detection, non-destructive methods.
Practical 10 Hrs Theory 05Hrs	Construct and explain circuit of electro-pneumatics and hydraulics observing standard operating procedure& safety aspect. (NOS: CSC/N9522)	34. Demonstrate Circuit construction with the use of Relays, Contactors, Electrical Timers, sensors, limits switches, types of actuators and solenoid valves. 35. Demonstrate Construction of single / double acting cylinder circuits–Direct & Indirect method, regenerative feed control, Load holding circuits (Hydraulic jack). 36. Explain electro-Hydraulic and Pneumatic circuits using actuators, proportional valves.	Identification of electro-hydraulic and electro pneumatic components by their schematic symbols. Function and operation of single acting, double acting, Differential cylinders and motors, types of actuators. Function and use of single & double solenoid valves and pressure switches. Function and use of different types of Directional controls, Pressure Controls, Flow controls, Check valve/Non-return valves.
Practical 20 Hrs Theory 10 Hrs	Demonstrate CNC turning centre/ CNC machining centre and produce components as per drawing by preparing part programme. (NOS: CSC/N9523)	37. Demonstrate and Practice on CNC machining centre–Basic operations – Offset measurement – Part program. 38. Assess and Edit the program on the machine. 39. Perform machining of simple components.	Introduction to CNC machining center- CNC system- Elements of CNC machine- Hardware & Software- Safety feature – Axes designation- offset measurement Types of Co-ordinate System-Preparatory codes (G-Codes and M –codes) – Cutting part program (Main & Sub) – Do‟s and Don‟t – routine maintenance – Trouble shooting.
Practical 30 Hrs	Produce components	40. Manufacture electrodes and Prepare die sinking EDM for	Principles of EDM - Advantages and applications

Theory 15 Hrs	using Electric Discharge machine (EDM) and Wire EDM as per drawing by preparing part programme with accuracy of ± 0. 02mm. (NOS: CSC/N9524)	machining and producing a square, rectangle, hexagon, Round, blind die cavities, through cavities and different profiles. 41. Demonstrate and prepare CNC wire cut EDM for machining – wire feeding – job setting and aligning- edge finding and centre finding – wire setting vertically. 42. Demonstrate CNC programming and machining of different profile of Punches.	of EDM – Spark erosion terminology – machine tool operating system – dielectric fluid – dielectric system – methods of flushing Electrode – material - application - manufacturing methods – methods of holding electrodes and alignment – determining electrode size and spark gap Work preparation and setting EDM parameters Trouble shooting and maintenance Principles of CNC Wire cut EDM - Advantages and applications Machine tool, power supply, dielectric supply and part programming Work preparation, work material, wire electrode, job mounting, and job reference point Water Dielectric-characteristics, dielectric strength and flushing.
Practical 30 Hrs Theory 15 Hrs	Demonstrate 2D & 3D machining with CAM software. (NOS: CSC/N9525)	43. Demonstrate Programming for simple and complicated profile using CAM software, simulation and offloading to machine. 44. Demonstrate CNC programming and machining different shapes of Die holes with land and taper on CNC wire cut EDM. 45. Exhibit measurement using CMM. 46. Demonstrate measurement of surface roughness.	optical comparator, and CMM – Introduction, working principles, parts and functions, construction, application and types of operations Shearing theory– cutting and non-cutting operations Cutting clearance, Land and angular clearance. Calculation of cutting force Introduction to surface roughness-instruments and its measuring principle.
Practical	Demonstrate	47. Manufacture Box Jig and	Jigs and fixtures –Definition,

10 Hrs Theory 05 Hrs	manufacturing and assembling of drill Jig and check for correctness of produced component. (NOS: CSC/N9526)	Angle plate jig. 48. Produce component on drill machine by using Jigs and check for correctness.	basic elements, advantages and applications in batch production and mass production.
Practical 10Hrs Theory 05Hrs	Demonstrate manufacturing and assembling of Fixture (milling, turning and grinding) & test dimensional accuracy. (NOS: CSC/N9527)	49. Manufacture "V" Block angle grinding Fixtures and profile milling fixture. 50. Produce component using fixture and check for dimensional accuracy.	Design features of jigs and fixtures. Economy and cost of jig and fixture. Planes and movements and arresting degrees of freedom. Locating principle and types of locators. Clamping principles and types of clamps. Drill bushes- types, size, accuracy and material. Types of drill jigs, parts and functions Types of Milling fixtures, parts and functions Welding fixtures – Construction principles, parts and function.
Practical 80 Hrs Theory 25 Hrs	Construct and assemble different Press tools viz. Piercing &Blanking tool, Progressive tool, Compound Tool and verify the component. (NOS: CSC/N9528)	51. Manufacture simple Blanking & piercing Tool. 52. Produce component using Blanking & piercing Tool and check for dimensional accuracy.	Introduction on Quality control, Inspection of tool and gauges, Product inspection, awareness on ISO and importance Different tooling and applications, Methods of Press tool Press –Tool nomenclature.
		53. Manufacture Progressive tool for producing a Cycle chain link. 54. Produce component using Progressive tool and check for dimensional accuracy	Stock material, strip layout and Economic factor Cutting force calculation punch and die – Types and materials Strippers types and functions Constructions of progressive tool
		55. Manufacture Combination tool & Compound Press tools by a group - as project 56. Produce component using	Stoppers types and functions Pilot locations and sizes, Side cutters Working principle of Ejector and shedder

		Combination tool & Compound Press tools and check for dimensional accuracy.	Compound tool, and combination tool-function-construction Side cam tool – function-advantages-working principles
Practical 10 Hrs Theory 05Hrs	Construct and assemble draw tool (single stage) and test to verify the component. (NOS: CSC/N9529)	57. Manufacture Draw tool as a Project. 58. Produce component using Draw tool and check for dimensional accuracy.	Deep draw tool function and calculation Introduction to Press, parts, functions, Classification of presses, and specification
Practical 21 Hrs Theory 09 Hrs	Construct and assemble "V" bending tool & test the component. (NOS: CSC/N9530)	59. Manufacture simple V and U bending tool by group as a project. 60. Trial out On Fly press and power press the Produced components such as V, U, etc.	Selection of press- Shut height and day light clearance Safety precaution on press work Strip feeding, Die cushion Fine blanking –Application, working principle, clearance tool life, punch and die radius. Tool estimation.
Practical 10 Hrs Theory 05Hrs	Plan, demonstrate and perform simple repair, overhauling of different Jig, fixture and press tool and check for functionality. (NOS: CSC/N9531)	61. Trouble shooting-Rectifications –Maintenance of Jig, fixture and press tool.	Introduction of TPM and TQM. Basic machine tool maintenance and its importance
Practical 10 Hrs Theory 05Hrs	Construct a Hand Injection Mould and try out the mould assembly. (NOS: CSC/N9532)	62. Manufacture hand injection mould. (May use the plates used in turning, milling and grinding exercise). 63. Try out and rectification.	**Hand injection mould:** Introduction to plastic material: Types of plastics, differentiation of plastics, Properties, application, fillers and additives and reinforced plastics. Mould terminology: Core, cavity, impression, runner, gate, sprue bush, mould base etc. Parting line: Types of parting

			line, mould matching (Bedding down), vent and relief. Requirement for ejection: Types of ejector grids, ejector elements and ejector system. Feed System: Sprue, runner, gate, types, design and calculations, vent design, balancing, etc.
Practical 22Hrs Theory 08Hrs	Explain and construct two cavity injection mould and try out the mould assembly. (NOS: CSC/N9533)	64. Develop isometric drawing and manufacture 2 cavity injection moulds in a group of 5 trainees using various tool room machines (conventional and non-conventional machines). 65. Try out component and rectification.	Injection moulding machines: Introduction, clamping system/ injection system terminologies and specifications, screw terminology construction of screw, types of moulding machines, and sequence in the moulding cycle. Selection of mould base, material and no. of cavities: Introduction, Selection of mould base and material, advantages and disadvantages of single/ multi-cavity mould, calculation of no. of cavities.
Practical 10 Hrs Theory 05Hrs	Illustrate and explain function of basic electrical circuit and sensors. (NOS: CSC/N9534)	66. Measure Current, Voltage and Resistance using simple Ohm`s Law Circuit and familiarizing multi-meter. 67. Demonstrate Soldering Techniques. 68. Demonstrate working with Solenoids and Relays. 69. Demonstrate working of Motor & generators. 70. Demonstrate behavior of Proximity Sensors. 71. Demonstrate behavior of ultrasonic sensors. 72. Demonstrate logical operation of sensors	Study of basic Electricals-Voltage –Current etc. Working of Solenoids, Inductors, Motors, Generator Based on Electromagnetic Induction Principle Switches, Fuse and Circuit Breakers Introduction to Sensors--Fundamental of Sensor Proximity Sensors Classification and Operation-Proximity Sensor-Types of Proximity Sensor and Their Working-Industrial Application

		73. Demonstrate Limit & Level Control using Sensors. 74. Demonstrate Interfacing of Sensors with Electrical Actuators.	Sensors for Distance and Displacement -LVDT-Linear Potentiometer -Ultrasonic and Optical Sensors-Industrial Application
Practical 10Hrs Theory 05Hrs	Construct and explain single cavity mould (Compression mould/ plunger type transformer mould). (NOS: CSC/N9535)	75. Manufacture single cavity plunger type transfer mould in a group of 5 trainees using various tools room machine (conventional and non-conventional) OR Construct a single cavity compression mould in a group of 5 trainees using various tool room machine (conventional and non-conventional).	Moulding of thermoset materials: Introduction, processing method, compression moulding, definition, pellet, compression moulding types, advantages and disadvantages of semi positive and fully positive mould, automatic compression mould, mould heaters and thermo couples, etc. , Transfer moulding, types of transfer moulding, advantages and disadvantages of transfer moulding, Injection moulding of thermo set material, Advantages and disadvantages of injection moulding of thermo set material, Compression/ transfer moulding defects. Introduction of blow moulding, types of blow moulding advantage and disadvantage of blow moulding. Material used in blow moulding, blow moulding fault & remedy.
Practical 37 Hrs Theory 08Hrs	Illustrate and explain isometric drawing and construct two cavity moulds with side core. (NOS: CSC/N9536)	76. Develop isometric drawing and manufacture 2 cavity injection moulds with side cavities in a group of 5 trainees using various tool room machines (conventional and non-conventional). 77. Assemble all the parts of	Injection moulding defects: Introduction, common faults, possible problems and remedies, analysis of moulding problems and solutions. Maintenance of mould: Introduction, upkeep and

		mould and tryout and find out fault of component and rectification. 78. Prepare different types of documentation as per industrial need by different methods of recording information for the project.	maintenance, types of maintenance of idle moulds, maintenance control, and frequency of maintenance. Die cast mould: Introduction to Die casting, Die casting, gating system design, force calculation, defects and remedies. Die and mould economics: Estimation and casting of mould raw material, machining hour rate, business transactions, cost of components, activity based costing, estimation of moulds and standard items.
Engineering Drawing: 30 Hrs.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)	**CIRCLES, TANGENTS AND ELLIPSE:** Practical applications procedure for constructing tangent to given circle-lines- loop pattern-- tangential circles- external tangents- internal tangents ellipse **PARABOLIC CURVES, HYPERBOLA:** Involutes - Properties and their application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral **TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS:** Views of object Importance of technical sketching-types of sketches-Isometric drawing sketching- Oblique drawing sketching. **PROJECTIONS**: Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines–determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids. **ISOMETRIC VIEWS**: Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop. **SECTIONAL VIEWS:** Importance and salient features, Methods of representing sections, conventional sections of various materials,	

		classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, Rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects. - **DEVELOPMENT AND INTERSECTIONS:** Development of surfaces- Types of surface- Methods of development-Intersection- Methods of drawing intersection lines-critical point or key point. **FASTENERS**: Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly. **DETAIL DRAWING AND ASSEMBLY DRAWING:** Details of machine drawing- Assembly drawing- surface quality-surface finish standard- Method of indicating surface roughness for general engineering drawing-symbols used for indication of surface roughness-symbols for direction of lay. Geometrical tolerance. Detail drawing of the following with complete dimensioning, tolerances, material and Surface finish specifications 1. Universal couplings 2. Ball bearing and roller bearing. 3. Fast and loose pulley. 4. Stepped and V belt pulley. 5. Flanged Pipe joints, right angle bend. 6. Tool Post of Lathe Machine. 7. Tail Stock of Lathe Machine 8. Stepped and V belt pulley. 9. Flanged Pipe joints, right angle bend. 10. Tool Post of Lathe Machine. 11. Tail Stock of Lathe Machine Practice of blue print reading on limit, size, fits, tolerance, machining symbols, and reading out of assembly drawing etc. , ISO Standards. **READING OF ENGINEERING DRAWING:** Blue print and machine drawing reading exercises. **GRAPHS & CHARTS**: Types (Bar, Pie, Percentage bar, Logarithmic), Preparation & interpretation of the graphs and charts.

		AUTO CAD: Familiarization with AutoCAD application in engineering drawing. Practice on AutoCAD using Draw & Modify commands. Practice on AutoCAD with Rectangular snap using Draw, Modify, Inquiry commands. Practice on AutoCAD using text dimensioning& dimensioning styles Practice on AutoCAD to draw nuts, bolts & washers. Isometric views-isometric views with square, taper and radial surface-simple & complex views. Perspective views. Practice on AutoCAD using isometric snap to make isometric drawings Practice on AutoCAD using Hatch command and application. Practice on AutoCAD using 3D primitives with UCS (User Co-ordinate system).
WORKSHOP CALCULATION & SCIENCE: 30 Hrs.		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)	**<u>WORKSHOP CALCULATION:</u>** **Fraction:** Concept of Fraction, Numbers, Variable, Constant, **Ratio & Proportion**: - Trade related problems **Percentage:** Definition, changing percentage to decimal and fraction and vice versa. Applied problems related to trade. Estimation and cost of product. **Algebra:** Fundamental Algebraic formulae for multiplication and factorization. Algebraic equations, simple & simultaneous equations, quadratic equations and their applications. **Mensuration 2D:** Concept on basic geometrical definitions, basic geometrical theorems. Determination of areas, perimeters of triangles, quadrilaterals, polygons, circle, sector etc. **Mensuration 3D:** Determination of volumes, surface areas of cube, cuboids cylinders, hollow cylinder, sphere prisms, pyramids cone spheres, frustums etc. Mass, Weight, Volume, Density, Viscosity, Specific gravity and related problems. **Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Trigono metrical ratios and their relations. Review of ratios of some standard angles (0, 30, 45, 60, 90 degrees), Height & Distances, Simple problems. **Graphs:** basic concept, importance. Plotting of graphs of simple linear equation. Related problems on ohm's law, series-parallel combination. **Statistics:** Frequency tables, normal distribution, measure of central tendency – Mean, Median & Mode. Concept of probability. Charts like pie chart, bar chart, line diagram, Histogram and frequency polygon. **WORKSHOP SCIENCE:** **Units and Dimensions:** Conversions between British & Metric system of Units.

		Fundamental and derived units in SI System, Dimensions of Physical Quantities (MLT)-Fundamental & Derived. **Engineering Materials:** Classification properties and uses of ferrous metals, non-ferrous metals, alloys etc. Properties and uses of non-metals such as wood, plastic, rubber, ceramics industrial adhesives. **Heat & Temperature:** Concepts, differences, effects of heat, different units, relation, specific heat, thermal capacity, latent heat, water equivalent, mechanical equivalent of heat. Different Temperature measuring scales and their relation. Transference of heat, conduction, convection and radiation. Thermal Expansion related calculations. **Force and Motion**: Newton's laws of motion, displacement, velocity, acceleration, retardation, rest & motion such as linear, angular. Force – units, different laws for composition and resolution of forces. Concept on centre of gravity and equilibrium of forces in plane. Concept of moment of inertia and torque. **Work, power & energy**: Definitions, units, calculation & application. Concept of HP, IHP, BHP and FHP – related calculations with mechanical efficiency. S. I. unit of power and their relations. **Friction:** Concept of friction, laws of friction, limiting friction, coefficient of friction and angle of friction. Rolling friction & sliding friction with examples. Friction on inclined surfaces **Stress & Strain:** Concepts of stress, strain, modulus of elasticity. Stress- strain curve. Hook's law, different module of elasticity like Young's modulus, modulus of rigidity, bulk modulus and their relations. Poisson's ratio. **Simple machines:** Concept of Mechanical Advantage, Velocity Ratio, Efficiency and their relations. Working principles of inclined plane, lever, screw jack, wheel and axle, differential wheel and axle, worm and worm wheel, rack and pinion. Gear train. **Electricity:** Basic definitions like emf, current, resistance, potential difference, etc. Uses of electricity. Difference between ac and dc. Safety devices. Difference between conductors and semiconductors and resistors, Materials used for conductors, semiconductors and resistors. Ohm's Law. Series, parallel and series-parallel combination of resistances. Concept, definitions and units of electrical work, power and energy with related problems.

		Fluid Mechanics: Properties of fluid (density, viscosity, specific weight, specific volume, specific gravity) with their units. Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum and differential pressure.

SYLLABUS FOR CORE SKILLS
1. Training Methodology (Common for all CITS trades) (270Hrs + 180Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Demonstrate & comply with safe working practices, environment regulation and housekeeping. (NOS: CSC/N9511)	Exhibit and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Identify and report all unsafe situations according to site policy.
	Identify and take necessary precautions on fire and safety hazards, Demonstrate use of different fire extinguisher, Exhibit site evacuation procedures and report according to site policy.
	Identify, handle and store/dispose of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	Exhibit do's and don'ts on safety alarms accurately.
	Demonstrate and act in the event of accident or sickness of any staff, demonstrate use of basic first aid, report Competent authority and record accident details.
	Exhibit Personal Protective Equipment (PPE) and Demonstrate use of the same as per related working environment.
	Demonstrate use of energy and materials in an environmentally friendly manner and Identify environmental pollution & demonstrate to avoidance of same.
	Avoid waste and dispose waste as per procedure.
	Exhibit different components of 5S and demonstrate to apply the same in the working environment.
2. Demonstrate and produce components by different operations and check accuracy using appropriate measuring instruments. *[Different Operations – Drilling, reaming, Tapping, Dieing; Appropriate Measuring Instruments – Vernier caliper, Screw Gauge, Micrometer]* (NOS: CSC/N9512)	Plan &demonstrate tools, instruments and equipments for marking and make this available for use in a timely manner.
	Mark as per drawing applying desired mathematical calculation and observing standard procedure.
	Arrange Tools, equipments and machineries for required operations and make these available for use in a timely manner.
	Perform required operations viz., Drilling, reaming, Tapping, Dieing to close tolerance as per specification in drawing to make the job.
	Observe safety procedure during above operation as per standard norms and procedures.
	Check for dimensional accuracy as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
3. Explain preparation of different cutting tool to produce jobs to appropriate accuracy by performing different turning operations.	Show cutting tool materials used on lathe machine as per their application.
	Plan and demonstrate grinding of different cutting tools.
	Check accuracy/ correctness of tool angles using appropriate gauge and measuring instruments for their functional requirement.
	Avoid waste, ascertain unused materials and components for

[Different cutting tool – V tool, side cutting(LH & RH), parting, thread cutting.] (NOS: CSC/N9513)	disposal, store these in an environmentally appropriate manner and prepare for disposal.
4. Demonstrate and perform different turning operations. *[Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: - ±0. 06mm, Different turning operation – facing, Plain / Parallel Turning, Step Turning, parting, chamfering, U – cut/ grooving, drilling, boring (counter & stepped), Reaming, internal recess, knurling].* (NOS: CSC/N9514)	Demonstrate mounting of appropriate work holding device, mount the job and set machine parameter to perform turning operations.
	Perform turning operations viz. , facing, Parallel Turning, Step Turning, chamfering, grooving, U-cut, parting, drilling, boring(counter & stepped), Reaming, internal recess and knurling to make component as per specification of the drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
5. Demonstrate Setting of different machining parameters to produce taper/angular components and ensure proper assembly of the components. *[Different component of machine: form tool, Compound slide, tail stock offset; Different machine parameters – feed, speed, depth of cut.* (NOS: CSC/N9515)	Plan, select and demonstrate appropriate method to produce taper/angular components.
	Exhibit and prepare cutting tool in compliance with standard parameters.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement and suit to male/female part.
	Test the proper assembly of the taper/angular components.
6. Demonstrate and produce threaded components and check for proper assembly of the components with an accuracy of ± 0. 05 mm. *[Different threads viz. , metric/ BSW/ Square]* (NOS: CSC/N9516)	Plan, select and demonstrate appropriate method to produce threaded components.
	Demonstrate and prepare thread cutting tool in compliance with standard thread parameters.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement and suit to male/female part.
	Test the proper assembly of the threaded components.
7. Exhibit different	Exhibit different work and tool holding devices and demonstrate

machining parameters and cutters to produce job by performing different milling operation and indexing. *[Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, stepped, angular, dovetail, T-slot, contour, gear milling]* (NOS: CSC/N9517)	functional application of each device.
	Demonstrate mounting of the work and tool with required alignment and check for its functional usage to perform required milling operations.
	Demonstrate to produce components as per drawing performing milling operations viz. , plain, stepped, angular, dovetail, T-slot, contour, gear milling .
	Observe safety procedure during mounting as per standard norms.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
8. Demonstrate and Produce components of high accuracy by surface and cylindrical grinding operation. *[accuracy of +/- 0. 02 mm]* (NOS: CSC/N9518)	Plan, select and demonstrate appropriate method to produce the work piece as per drawing.
	Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner.
	Set the job on grinding machine and grind as per specification /drawing following standard operating practice.
	Check the dimension of the job using appropriate gauge and measuring instruments
9. Exhibit sharpening of different cutter or multipoint cutting tool. *[Different cutters – end mill cutter, side & face milling cutter, single angle cutter, Reamer]* (NOS: CSC/N9519)	Plan and demonstrate setting of the cutter or multipoint cutting tool to the machine.
	Select and Set the appropriate grinding wheel and safety guards.
	Sharpen the cutting tool observing standard operating procedure.
	Check accuracy/ correctness of tool angles using appropriate gauge and measuring instruments for their functional requirement.
10. Develop and explain drawing of press tool components and solid modeling of mould using CAD. (NOS: CSC/N9520)	Exhibit the working principle of the software.
	Demonstrate simple drawing in computer using Auto CAD.
	Demonstrate to draw an assembly drawing in computer.
	Demonstrate to draw press tool components.
	Demonstrate to draw solid modelling of mould.
	Draw and illustrate assembly drawing of press tool / mould.
11. Demonstrate and perform heat treatment of work piece/job & measure hardness, stress, strain, elongation, and modulus of given metals. (NOS: CSC/N9521)	Plan, select and demonstrate appropriate method of heat treatment to produce required hardness / property in the work piece.
	Perform required heat treatment process observing standard operating procedure.
	Demonstrate testing of hardness and other properties of metals.

12. Construct and explain circuit of electro-pneumatics and hydraulics observing standard operating procedure & safety aspect. (NOS: CSC/N9522)	Plan, select and demonstrate construction of pneumatics & hydraulics circuit as per drawing.
	Construct circuit of pneumatics and hydraulics observing standard procedure.
	Comply with safety rules when performing the above operations.
	Check different parameters and functionality of the system.
13. Demonstrate CNC turning centre/ CNC machining centre and produce components as per drawing by preparing part programme. (NOS: CSC/N9523)	Plan, prepare and exhibit part programme as per drawing, simulate for its correctness with appropriate software.
	Prepare and demonstrate tooling layout and select tools as required.
	Set selected tools on the machine.
	Test/Dry run the part programme on the machine.
	Set up the job and machine the component as per standard operating procedure involving operations on CNC turning centre/ CNC machining centre.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
	Observe safety/ precaution during machining.
14. Produce components using Electric Discharge machine (EDM) and Wire EDM as per drawing by preparing part programme with accuracy of ± 0. 02mm. (NOS: CSC/N9524)	Exhibit parts and working principle of EDM.
	Prepare required electrode as per drawing and check dimensions.
	Demonstrate and Produce components using Electric Discharge machine (EDM) observing standard procedure.
	Exhibit parts and working principle of Wire EDM.
	Prepare part programme and simulate on wire cut machine.
	Demonstrate Produce components using Wire EDM as per drawing.
	Check accuracy/ correctness of the component using appropriate gauge and measuring instruments for their functional requirement.
15. Demonstrate 2D & 3D machining with CAM software. (NOS: CSC/N9525)	Plan and demonstrate contour and profile machining.
	Demonstrate to produce component on 2D & 3D machining.
	Check accuracy/ correctness of the component using appropriate gauge and measuring instruments.
16. Demonstrate manufacturing and assembling of drill Jig and check for correctness of produced component. (NOS: CSC/N9526)	Plan and Select appropriate tools, equipment and machine to produce the drill jig as per drawing and make these available for use in a timely manner.
	Demonstrate construction and assembly of drill jig following standard operating practice.
	Set the drill jig in appropriate machine and produce component to test observing standard operating practice.
	Observe safety precautions during operation of machine.
	Check the dimensions of the component for desired performance.
17. Demonstrate manufacturing and assembling of Fixture	Plan and Select appropriate tools, equipment and machine to produce required fixture as per drawing and make these available for use in a timely manner.

(milling, turning and grinding) & test dimensional accuracy. (NOS: CSC/N9527)	Demonstrate construction and assembly of required fixture following standard operating practice.
	Set the produced fixture in the machine and produce component to test observing standard operating practice.
	Observe safety precautions during operation of machine.
	Check the dimensions of the component for desired performance.
18. Construct and assemble different Press tools viz. Piercing &Blanking tool, Progressive tool, Compound Tool and verify the component. (NOS: CSC/N9528)	Plan and Select appropriate tools, equipment and machine to produce required Press tools as per drawing and make these available for use in a timely manner.
	Demonstrate construction and assembly of required Press tools following standard operating practice.
	Set the produced press tools viz. Piercing & Blanking tool, Progressive tool, Compound Tool in the machine and produce component to test observing standard operating practice.
	Observe safety precautions during operation of machine.
	Check the dimensions of the component for desired performance.
19. Construct and assemble draw tool (single stage) and test to verify the component. (NOS: CSC/N9529)	Plan and Select appropriate tools, equipment and machine to produce required draw tool as per drawing and make these available for use in a timely manner.
	Demonstrate construction and assembly of required draw tool following standard operating practice.
	Set the produced draw tool in the machine and produce component to test observing standard operating practice.
	Observe safety precautions during operation of machine.
	Check the dimensions of the component for desired performance.
20. Construct and assemble “V” bending tool & test. (NOS: CSC/N9530)	Plan and Select appropriate tools, equipment and machine to produce required “V” bending tool as per drawing and make these available for use in a timely manner.
	Demonstrate construction and assembly of required “V” bending tool following standard operating practice.
	Set the produced “V” bending tool in the machine and produce component to test observing standard operating practice.
	Observe safety precautions during operation of machine.
	Check the dimensions of the component for desired performance.
21. Plan, demonstrate and perform simple repair, overhauling of different Jig, fixture and press tool and check for functionality. (NOS: CSC/N9531)	Examine and identify faults / defects in Jig, fixture and press tool.
	Plan and Select appropriate tools, equipment and machine for the repair, overhauling and make this available for use in a timely manner.
	Demonstrate execution of repairing / overhauling of Jig, fixture and press tool with standard operating procedure.
	Demonstrate the assembly of parts in the Jig, fixture and press tool with the help of blue print.
	Check for functionality of repaired / overhauled Jig, fixture and press tool and ascertain/identify faults of the part in case of improper functioning.

22. Construct a Hand Injection Mould and exhibit try out the mould assembly. (NOS: CSC/N9532)	Plan and assess requirement of appropriate tools, equipment and machine for making different parts of a mould.
	Carry out work on various tool room machines for fabricating Mould.
	Demonstrate the assembly of the hand injection mould.
	Exhibit feed system, injection system and ejection system.
	Try out the mould using Hand Injection Moulding machine.
	Measure the component with instruments/gauges as per drawing.
	Avoid wastage, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
23. Explain and construct two cavity injection mould and try out the mould assembly. (NOS: CSC/N9533)	Interpret and explain the design of two cavity injection mould.
	Plan and assess requirement of appropriate tools, equipment and machine for making different parts of the mould.
	Carry out work on various tool room machines for fabricating the Mould.
	Demonstrate assembly of the mould
	Try out the mould using Injection Moulding machine.
	Measure the component with instruments/gauges as per drawing.
24. Illustrate and explain function of basic electrical circuit and sensors. (NOS; CSC/N9534)	Demonstrate and explain the measurement of current, voltage and resistance using simple Ohm's law circuit.
	Demonstrate and perform soldering techniques.
	Demonstrate and explain step up and step down transformers.
	Demonstrate and explain working of Motors and generators.
	Demonstrate and explain the Behaviour of Proximity Sensors and ultra sonic sensors and logic operation of sensors.
	Demonstrate and explain Limits and level control using sensors.
	Demonstrate and explain Interfacing of sensors with electrical actuators.
25. Construct and explain single cavity mould (Compression mould/ plunger type transfer mould). (NOS: CSC/N9535)	Interpret and explain the design of compression/transfer mould.
	Plan and assess requirement of appropriate tools, equipment and machine for making different parts of the mould.
	Carryout the work in various tool room machines for fabricating Mould.
	Demonstrate assembly of the compression/transfer mould.
	Demonstrate try out of the mould.
	Measure the component with instruments/gauges as per drawing.
26. Illustrate and explain isometric drawing and construct two cavity moulds with side core. (NOS: CSC/N9536)	Demonstrate, Develop and explain the isometric drawing for two cavity mould with side core.
	Plan and assess requirement of appropriate tools, equipment and machine for making different parts of the mould.
	Plan and carryout the work in various tool room machines for fabricating Mould.
	Explain about the actuation of slide and safety features of side core

	assembly.
	Demonstrate assembly of the mould with side core.
	Demonstrate try out of the mould.
	Measure the component with instruments/gauges as per drawing after moulding.
27. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)	Solve different mathematical problems
	Explain concept of basic science related to the field of study

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT TOOL & DIE MAKER CITS TRADE			
for batch of 25 candidates			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel rule	250 mm British and metric combined as per IS 1481	25+1Nos.
2.	Engineer's square	150 mm with knife edge as per IS 2103	25+1 Nos.
3.	Hacksaw frame adjustable with pistol grip	for 200-300 mm blade	25+1 Nos.
4.	Hammer ball peen with handle	0. 5kg	25+1 Nos.
5.	Chisel cold flat	18 x 150 mm	25+1 Nos.
6.	Centre punch	100 mm	25+1 Nos.
7.	Prick punch	150 mm	25+1 Nos.
8.	File flat bastard	350 mm	25+1 Nos.
9.	File flat 2nd cut	250 mm	25+1 Nos.
10.	File flat safe edge	200 mm	25+1 Nos.
11.	File square smooth	200 mm	25+1 Nos.
12.	File card		25+1 Nos.
13.	Screw Driver	200mm	25+1 Nos.
B. TOOLS, MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT			
14.	D. E. Spanner	6mm to 32 mm as per IS 2028	2 Set
15.	Allan Key	3 mm to 12 mm	3 Sets
16.	Hammer cross peen with handle	0. 1kg	6 Nos.
17.	Centre gauge		4 Nos.
18.	Oil cane	250 Ml.	5 Nos.
19.	File half round bastard	300 mm	5 Nos.
20.	File half round smooth	250 mm	5 Nos.
21.	File three square bastard	250 mm	5 Nos.
22.	File three square smooth	200 mm	5 Nos.
23.	File round bastard	250 mm	5 Nos.
24.	Knife edge file	150 mm	5 Nos.
25.	Needle file assorted	150 mm	5 Nos.
26.	Scribing block universal	300 mm	5 Nos.
27.	Granite surface plate grade	0 630 mm x 630 mm x 100mm	2 Nos.
28.	Tap extractor	3 mm to 12 mm x 1. 5 mm	2 sets
29.	Screw extractor	sizes 1 to 8	2 sets
30.	Taps and dies (metric) complete set in a box	3 mm to 12 mm	4 sets
31.	Drill twist straight shank	dia. 3 to 12. 0 mm in steps of 0. 5 mm	3 sets
32.	Taper shank drills	10 to 20 mm in steps of 1 mm	2 sets
33.	Letter punch set	3 mm	2 sets
34.	Number punch set	3 mm	2 sets
35.	Drill chuck, capacity	12 mm	2 Nos.

36.	Centre drills	No. 2, 3, 4	5 each
37.	Hammer – nylon and copper		2 Nos. each
38.	Scrapers – Flat, Triangular, half round		2 Nos. each
39.	Adjustable spanner	12”	2 Nos
40.	Grease gun		2 Nos.
41.	Parallel hand reamer	5, 6, 8, 10mm	4 sets
42.	Hand taper pin reamer	5mm, 6mm, 8mm, 10mm (set of 4Nos)	2 sets
43.	Slab milling cutter	dia 80 mm x 40 mm width x dia 22 bore	4 Nos.
44.	Side and face milling cutter	Ø125 x 12 mm width Ø 27 mm bore	4 Nos.
45.	Side & face milling cutter	Ø 100mm x 10 mm width, Ø 27 mm bore	4 Nos.
46.	Cylindrical milling cutter	Ø 63 mm x 100 mm length Ø 27 mm bore	4 Nos.
47.	Single angle cutter	Ø 63 mm x 18 mm width Ø 27 mm bore – 45°	4 Nos.
48.	Equal angle cutter	Ø 63mm x 18 mm width Ø 27 bore – 90°	4 Nos.
49.	Shell end mill cutter	dia 80 mm x 40 mm width x dia 22 bore	4 Nos.
50.	Shell end mill	dia 100 mm x 50 mm width x dia 32 bore	4 Nos.
51.	Involute Gear cutter	2 module (Three nos. in a set)	1 set
52.	Face mill cutter	dia 100 mm x 25 mm width x dia 32 bore	4 Nos.
53.	Parallel shank end mill	dia 5, dia 6, dia 8, dia 10 and dia 12 mm	4 No each
54.	T-slot cutter with parallel shank	dia 17. 5 x 8 mm width x dia. Of shank 8 mm	5 Nos.
55.	Slitting cutter	dia 100 mm x 2 mm width x 27 mm bore	4 Nos.
56.	Ball end mill	dia 3 mm, dia 6 mm, dia 8 mm, dia 10 mm and dia 12 mm.	4 Nos. each
57.	Tool makers clamp	50 mm, 75 mm, 100 mm and 150 mm	8 Nos. each
58.	“C” clamp	75 mm, 100 mm, 150 mm and 200 mm	4 Nos. each
59.	HSS tool bits	4mm, 6mm, 8mm square 100 mm length	25 Nos. each
60.	Tool holders	straight, LH and RH to suit 4, 6 & 8mm Sq. - tool size	8 each
61.	Parting tool holders	to suit the size of the lathe	4 Nos. each
62.	Parting tool blades	3 mm and 4 mm Thick HSS	6 each
63.	Boring bars to accommodate	4 mm, 6 mm and 8 mm HSS tool bits	6 each
64.	Knurling tool	revolving type(Straight & Diamond)	2 Nos. each
65.	Tool makers buttons	dia 10mm and dia 12mm	6 each
66.	Tool holders for shaper	Straight, LH and RH to suit the machine available	6 each

67.	Tool holders – straight, LH and RH to suit of lathe	4, 6, 8mm. sq. Bit HSS size	8 each
68.	Micro boring bar with suitable inserts	Dia 12 to 42 mm BT 40	2 Nos.
69.	Tap holder with standard length	Bt 40 ER 25	2 Nos.
70.	Oil stone assorted	(10 mm square, dia 10 mm and 10 mm side triangular) 100 mm length	4 each
71.	Star dresser		6 Nos.
72.	Diamond dresser with holder		6 Nos.
73.	Work bench	340 cm x 120cm x 75 cm with 150 mm vice	5 Nos. (each bench fitted with 4vices)
74.	8 Locker Steel cup board for trainees		3 Nos.
75.	Steel cupboard	6ft. or more	2 Nos.
76.	Metal rack	180 cm x 60 cm x 45 cm	2Nos.
77.	Fire extinguisher		4 Nos.
78.	Fire buckets with stand		4 Nos.
79.	Caliper inside spring type	150 mm	4 Nos.
80.	Caliper outside spring type	150 mm	4Nos.
81.	Divider spring type	150 mm	4 Nos.
82.	Odd leg caliper firm joint	150mm	4 Nos.
83.	Vernier Caliper as per IS 3651	200 mm	5 Nos.
84.	Vernier caliper –as per IS 3651	range 300 mm vernier scale – 0. 02 mm	2 Nos.
85.	Out side Micro Meter	(0 to 25mm) as per IS 2967	5 Nos.
86.	Out side Micro Meter	(25 to 50mm) as per IS 2967	5 Nos.
87.	Digital Outside micro meter	0 – 25 mm (0. 01mm accuracy)	1 No
88.	Inside micrometer	Range 50-63 mm with std extension rods upto 200mm	1 set
89.	Depth micrometer	Range 0-25 mm, accuracy 0. 01 mm with std set of extension rods.	1 set
90.	Digital Vernier height gauge	Range 300 mm vernier scale-0. 02 mm	1 No
91.	Digital Vernier height gauge	range 500 mm vernier scale – 0. 02 mm	2 Nos.
92.	Dial vernier caliper	0-200 mm, graduation – 0. 02 mm	2 Nos.
93.	Digital calipers	0-200 mm, graduation – 0. 02 mm	2 Nos.
94.	Gear tooth vernier caliper		2 Nos.
95.	Combination square sets – blade with square head, centre head, protractor head	300mm	2 sets
96.	Universal bevel protractor – blade, acute angle attachment as per IS 4239	range 150 and 300 mm, dial 1 degree, vernier 5‟ with head	2 Nos.
97.	Centre square –	blade size 400 x 250 mm	2 sets
98.	Telescopic gauge	range 8-150 mm(6 pieces/sets)	1 set
99.	Sine bar with stopper plate as per IS 5359	150 mm	2 Nos.

100.	Gauge Blocks Workshop Grade –	87 Pieces Per Set	2 sets
101.	Slip gauges – sets –accuracy as per IS 2984	112 pieces- grade-“00”	1 set
102.	V – block –with clamps as per IS 2949	approx. 32 x 32 x 41 mm with clamping capacity of 25 mm	1 pair
103.	V – block –with clamps as per IS 2949	approx. 65 x 65 x 80 mm with clamping capacity of 50 mm	1 pair
104.	Magnetic V-block	100 x 100 x 125 mm	1 pair
105.	Angle plate – adjustable	250 x 250 x 300 mm	2 Nos.
106.	Dial test indicator stand with magnetic base	60 x 47. 5 mm and with universal swivel clamp, dial holding rod (150 mm) scriber	2 Nos.
107.	Dial test indicator – lever type as per IS 11498	range 0-0. 8 mm – graduation 0. 001 mm, reading 0-40-0 with accessories	2 Nos.
108.	Dial test indicator – plunger type –with revolution counter. as per IS 2092	range0-10 mm – graduation 0. 001 mm, reading 0-100	2 Nos.
109.	Bore gauge with dial -range of bore gauge 18-25mm	indicator (1 mm range 0-0. 01 mm graduation)	2 sets
110.	Straight edge – single beveled	size 150 mm and 250 mm	1 each
111.	Parallel blocks in pairs as per IS 4241	15 mm and 25 mm	4 sets
112.	Height master with suitable measuring and spacing block	range 300 mm, graduation 0. 001 mm	1 No
113.	Three point internal micro meter	range 18 to 25mm with accuracy of 0. 005 mm	1 set
114.	Two pointself centering bore dial gauge	with accuracy of 0. 001 mm	1 No
115.	Feeler gauge as per IS 3179	0. 05 mm to 0. 3 mm by 0. 05 to 0. 4 mm to 1 mm by 0. 1 mm (13 LEAVES)	2 Sets each
116.	Screw pitch gauge	Range 0. 4 – 7 mm metric 60 degree (21 leaves)	2 sets
117.	Radius gauge	1-3 mm by 0. 25 mm and 3, 5-7 mm by 0. 5 mm (34 leaves)	2 sets
118.	Polishing kit		1 no.
119.	Surface roughness meter		02 Nos.
120.	Prismatic Angle gauges	IS 6231	1 set
121.	Master try square	150 mm	1 No.
122.	Spirit level	0. 02/1000 mm	1 No.
123.	Wheel balancing unit with stand	Size 150 mm x 150 mm x 250 height	1 No.
124.	Electric hand drill	¼”	1 No.
125.	Electric hand grinder – AG2		1 No.
126.	Rotary table to suit vertical milling m/c table slot		1 No each
127.	Equipment for conducting BLS (Basic Life Support) training. (Optional)		1 set

128.	Laptop with latest configuration		2 Nos.
129.	Auto cad 10 licenses software		1 set
130.	Personnel computer with latest configuration, Table, UPS and printer		13 Nos.
C. TOOLS & EQUIPMENT OF ELECTRICAL & SENSORS			
i) Electrical			
131.	Digital Multimeter	0 – 400 Volt	2 No.
132.	Variable Resistance Box, Resistors	With 220Ω, 150Ω, 1kΩ, 33Ω, 100Ω, 1. 2Ω	1 each
133.	Battery With Cap	9V DC	1 No.
134.	Dual Power Supply	230V, 50Hz, Fuse-800mA	1 No.
135.	Solder Iron, Solder Lead, PCB Board (Groove Board), Solder Wick	350V	1 set
136.	Inductor	(400 Turns, 200 Turns, 600 Turns, 1200 Turns) , I-Core , E-Core, U-Core, Laminated Core	1 each
137.	Relay, LED	(5V)	1 No.
138.	Function Generator	(230V, 50Hz, Watts-12VA, Fuse-150mA)	1 No.
139.	Bread Board		1 No.
140.	Synchronous Motor, Capacitor For Synchronous Motor	(240V, 60rpm), (0. 8mf ± 5% 450 VAC)	1 No.
141.	Power Chord, Connecting Probes, Single Strand & Multi strand Wires		As required
ii) Sensors			
142.	Power Supply	(0-30V DC, 3A)	1 No.
143.	**Sensor Kit**		1 set each
	i. Mounting Plate		
	ii. Power Distribution Box	(24V DC, 4A)	
	iii. Counter Box	(10-30V DC/0. 05A)	
	iv. Indication Box	(24V Dc)	
	v. Material Box		
	vi. Inductive Sensor	(10-30 V DC, PNP, NO, 5mm (Range))	
	vii. Capacitive Sensor	(10-30 V Dc, PNP, NO, 2-8mm(Range))	
	viii. Magnetic Sensor	(10-60 V DC , PNP, NO, 60mm (Range))	
	ix. Ultrasonic Sensor	(20-30 V DC, PNP, NO, 80-300mm(Range))	
	x. Connecting Wires		
	xi. Motor With Control Unit	(24V DC, 1A)	
C : GENERAL MACHINERY			
144.	SS and SC centre lathe (all geared) with having minimum specification as:	Centre height 150 mm and centre distance 1000 mm along with 4 jaw and 3 jaw chucks, auto feed system, safety guard, motorized coolant	4 Nos.

		system and lighting arrangement. Revolving centre 1 No Quick change tool post with 5 Nos. of tool holders along with other standard accessories like face plate, set of carriers, taper turning attachment.	
145.	Horizontal Milling Machine with minimum specification as: (with DRO)	Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement and 150mm Universal vice.	2 Nos.
146.	Vertical Milling Machine with minimum specification as: (with DRO)	Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement in X-Y direction along with 150mm universal vice.	2 Nos.
147.	Universal Milling machine with minimum specification as:	Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement and with following attachments such as: a. Vertical head b. Slotting attachment c. Rack cutting attachment d. Rotary table e. Dividing head f. Adaptors, arbors and collects etc. for holding straight shank drills and cutters from 3 mm to 25 mm.	2 Nos.
148.	Double ended Pedestal Grinder	Dia. Of wheel – 200 mm with standard accessories	2 Nos.
149.	Surface grinding machine hydraulic, horizontal spindle reciprocating table manual and auto cross feed, adjustable traverse stop, auto reverse cross movement, power raise and fall of wheel head,	Wheel speed – 2800 rpm Table size - 650 x 150 mm Fine down feed - 0. 001 mm Accessories: wheel guards, coolant system with baffle tank and motor, magnetic chuck 300x150mm, wheel balancing mandrel, additional wheel flange with mandrel, wheel balancing stand, wheel truing device, spare grinding wheel for general purpose grinding and standard accessories	2 Nos.
150.	Grinding machine hydraulic external cylindrical, universal type with internal grinding attachment fully motorized and standard accessories.	Centre height - 150mm Distance between centers- 800 mm Least in-feed - 0. 0025 mm Accessories: Face plates and driving dog carriers, 3 jaw self-centering chuck, 4-jaw independent chuck, tailstock, fixed steady, adjustable steady, wheel dressers for external and internal	1 No.

		grinding wheels, straight carriers for holding different diameter shafts, coolant tank assembly with coolant filtration and circulation system, carbide tipped centers(half/full), wheel guards, front guard, (each machine supplied with assorted grinding wheels for general purpose work of internal and external grinding)	
151.	Tool and cutter grinding machine universal, tilting wheel head and power raise and fall of wheel head attachment, and standard accessories.	Distance between centre -760 mm, Accessories: Grinding flanges 50 mm & 75 mm, Wheel guards with long and short holders, Grinding wheel arbors with flanges, 100 mm long x 75 mm flange dia. , Universal work head with indexing mechanism suitable for 24 divisions, Sleeves Morse No. 5/4, 5/3, 5/2, and ISA – 50/40, collet holder with set of collets for holding end mill cutters, RH and LH tail stock with centre, Clearance angle setting device with carriers, Centre height setting gauge, Universal tooth rest assembly with fixed tooth support and universal tooth support, Different shapes of tooth rest fingers, Wheel truing attachment , Clamping arbor for tools with ISA taper, Mandrel 16 mm dia. , Mandrel 22 mm dia. , Mandrel 27 mm dia. set of silicon carbide(green)grinding wheels, Universal vice, Lighting equipment, Inspection mandrel, Diamond dressing tool with holder, Assorted grinding wheels for all tool room work, and Standard hand tools	1 No.
152.	Rockwell Hardness Testing Machine	Scale for HRA, HRS, and HRC provided. With std. accessories	1 No.
153.	Drilling machine, box column type upright	25 mm capacity with other standard accessories	2 Nos.
154.	Sensitive drilling m/c 12mm	Capacity 20 mm with other standard and required optional accessories	1 No
155.	Muffle furnace	300 x 300 x 450 mm for 1100 to 1200 degree C with standard and required optional accessories	2 Nos.
156.	Quenching tank with Agitation	600 x 600 x 600 mm	2 Nos.
157.	Bench drilling machine	Capacity 12 mm –std with std accessories	2 Nos.
158.	Spark erosion EDM with		1 No.

	standard accessories		
159.	Hand Injection Moulding Machine	approx. 50 g capacity	1 No.
160.	Hand Compression Moulds	Compression moulding process (Mechanical for 50 gms) Minimum 25 Ton capacity.	1 No.
161.	Screw Type Injection Moulding Machine	(capacity 50 gms) (Not required if plastic processing operator trade is available in the institute) Minimum 25 Ton capacity	1 No.
162.	Multimedia CNC teach ware and simulation software		2 Nos.
163.	CNC milling machine/ Vertical machining centre (VMC)	[specification as per Annex-A & A (II)]	As per Annex-A & A (II)
164.	CNC lathe/CNC turn Centre	[specification as per Annex-A & A (I)]	As per Annex-A & A (I)
165.	Profile projector (optional)		1 No.
166.	Fly press (any model)	Minimum 2 tonne capacity	2 Nos.
167.	Power press m/c (mechanical/Hydraulic)	Minimum 5 tonne capacity standard and required optional accessories	1 No.
168.	Power hacksaw machine	to accommodate 21" or more length blade	1 No.
E. CLASS ROOM FURNITURE			
169.	Instructor's table and Chair (Steel)		1 set.
170.	Students chairs with writing pads		25nos.
171.	White board size	1200mm X 900 mm	1 No.
172.	Instructors laptop with latest configuration pre-loaded with operating system and MS Office package.		1 No.
173.	LCD projector with screen.		1 No.
174.	CD & DVD of different joint related to carpenter works and variety design of modern furniture		1 set each (optional)
175.	Visualizer (latest configuration)		1 no.
CNC LAB			
176.	CNC Lathe	As per Annexure – A (I)	1 No.
177.	CNC Machining Centre	As per Annexure – A (II)	1 No.
178.	Desktop Computer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM: -4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with	1 No.

		trade related software	
179.	Printer	Laser/ Inkjet	1 No.
180.	Air Conditioner - Split		As required
181.	UPS		As required

ANNEXURE-A (I)

DETAILED SPECIFICATION FOR CNC LATHE			
1.	**MACHINE CAPACITY**	**Units**	**Size**
a	Max. load on Chuck	kg	Maximum 40
b	Machine weight nett	kg	1500 or higher
2.	**SPINDLE**		
a	Maximum spindle speed	RPM	4000 or higher
b	Type of drive	AC servo spindle motor (digital)	
c	Front Bearing Dia. (ID)	mm	60 or higher
3.	**AXES**		
a	X - axis Travel	mm	200 or higher
b	Z - axis Travel	mm	290 or higher
c	Rapid traverse - X	m/min	10/15 or higher
d	Minimum programmable command- X/ Z	mm	0. 001
e	Programmable feed range - X, Z axes	mm/min	10 - 10000
f	Type of drive	AC servo motor	
g	Motor Torque - X axes	Nm	3 or higher
h	Motor torque - Z axis	Nm	6 or higher with brake
5.	**ACCURACY as per ISO 230-2**		
a	Positioning accuracy for X, Y& Z axes	mm	0. 012
b	Repeatability for X, Y& Z axes	mm	±0. 007
6.	**CNC SYSTEM**		
a	Control System	FANUC/Siemens	
b	Machine control panel	Feed rate, spindle speed override knob	
c	MPG (Manual pulse generator)	On machine operator panel	
d	CNC Features	Tool Offsets MDI	
7.	**COOLANT/LUBRICATION**		
a	Coolant tank Capacity	Litres	100 or higher
b	Coolant pump motor	kW	0. 25
c	Coolant pump output	lpm	20 or higher
8.	**POWER SOURCE**		
a	Mains supply (± 10 %)		415 V, 3 Ph. , 50Hz
b	Total connected load requirement		Approx. 15 kVA
9.	**STANDARD EQUIPMENT**		
a	Voltage Stabilizer	15 kVA	
b	Backup CD for PLC Ladder Logic	1 no.	
c	Machine lightning	1 no.	
d	Levelling pads and jacking screws	4 nos.	
e	Operation manual	1 no.	
f	Maintenance manual	1 no.	
g	Installation kit	1 no.	
h	Maintenance tool kit	1 no.	
10.	**MAKES OF CRITICAL COMPONENTS**		
a	LM Guideways	HIWIN/THK/PMI/STAR	
b	Ball Screws	HIWIN/THK/TSUBAKI/PMI/STAR/HMT/NSK	

c	Spindle Bearings	RHP/NSK/FAG/SKF/NRB				
d	Stabilizer	NEEL/SE RVOMAX/CONSUL/FARMAX				
e	Lubrication	CENLUBE/DROPCO				
f	Coolant Pump	RAJAMANE/GRU NDFOS				
11.	**Cutting Tools & Tool Holders (for BT30 or BT40 as per machine supplied)**					
S No.	**Item**	**Quantity**		**Inserts**	**Quantity**	
		1 year	**3 years**		**1 year**	**3yrs**
	OD turning tool	2	4	Suitable inserts	5 sets	15
b.	OD grooving tool	2	4	Suitable inserts	5 sets	15
c.	Thread cutting tool	2	4		20	60
d.	ID turning tool	2	4		20	60
e.	ID threading tool	2	4	Suitable inserts	10	30
f.	C spanner for tightening tools in holder	1	2			
g.	Magnetic dial stand	1	2			
h.	Mallet	2	4			
i.	Tap wrench	1	2			
j.	Hands tools set (spanners, Allen keys, etc. ,)	1 box				
k.	T Nuts, Strap clamps, Clamping Nuts and studs	1 set				
l.	Hands tools set (spanners, Allen keys, etc. ,)	1 box				
m.	T Nuts, Strap clamps, Clamping Nuts and studs	1 set				

ANNEXURE-A (II)

DETAILED SPECIFICATION FOR CNC MACHINING CENTRE			
1.	**MACHINE CAPACITY**	**Units**	**Size**
a	Table size	mm	500x250 or higher
b	Max. load on table	Kg	150 or higher
c	T slot dimension (N x W x P)	mm	3 x 14 x 100 or higher
d	Table height from floor	mm	800 ~ 900
e	Cast Iron grade for bed and saddle	Grade 25 or equivalent	
f	Machine net weight	kg	1500 or higher
2.	**SPINDLE**		
a	Spindle nose	BT30 / BT40	
b	Minimum distance (spindle nose to table)	mm	100 - 150
d	Maximum spindle speed	RPM	6000 or higher
e	Spindle power, continuous	kW	3. 7 or higher
f	Type of drive	AC servo spindle motor (digital)	
g	Spindle bearing class	P4	
h	Front Bearing Dia. (ID)	mm	50 or higher
3.	**AXES**		
a	X - axis Travel	mm	300 or higher
b	Y - axis Travel	mm	250 or higher
c	Z - axis Travel	mm	250 or higher
d	Rapid traverse - X/Y/Z	m/min	20/20/20 or higher
e	Minimum programmable command- X/Y/ Z	mm	0. 001
f	Programmable feed range - X, Y & Z axes	mm/min	10 - 10000
g	Type of drive	AC servo motor	
h	Motor Torque - X & Y axes	Nm	3 or higher
i	Motor torque - Z axis	Nm	6 or higher with brake
j	Ball screw - X, Y & Z axes (diameter x pitch)	mm	25 x 10 or higher
k	Ball screw finish - X, Y & Z axes	Ground and hardened	
l	Ball screw class - X, Y & Z axes	Pre-loaded with C3 or better	
m	Guideways - X, Y & Z axes	Antifriction linear motion guideway	
n	Guideways size - X, Y & Z axes	mm	25 or higher
o	Guideway precision - X, Y, & Z axes	P Class	
4.	**AUTOMATIC TOOL CHANGER**		
a	Number of tool pockets	nos.	8 or higher
b	Max tool diameter	mm	80 or higher
c	Tool selection	Bi-directional	
d	Tool shank type	BT30 / BT40	
e	Tool weight max	kg	2. 5 for BT30 / 6 for BT40
f	Tool length max	mm	100 ~150 for BT30 / 150~200 for BT40
g	Tool change time (chip to chip)	sec	5 or lower
h	Tool clamp & unclamp	Disc Spring & Hydro-Pneumatic	
5.	**ACCURACY as per ISO 230-2**		

a	Positioning accuracy for X, Y& Z axes	mm	0. 012
b	Repeatability for X, Y& Z axes	mm	±0. 007
c	Geometrical Alignment		ISO 10791-Part 1
d	Accuracy of finish test piece		ISO 10791-Part 7
6.	**CNC SYSTEM**		
a	Control System	FANUC/Siemens	
b	Motors & Drives	Compatible with CNC controllers as mentioned above	
c	System resolution	0. 001 mm	
d	Tool number display	On machine operator panel	
e	Machine control panel	Feed rate, spindle speed override knob	
f	MPG (Manual pulse generator)	On machine operator panel	
g	CNC Features	Graphic Simulation, Programming help, Tool Offsets MDI	
		Absolute/Incremental Positioning, Pitch error compensation	
7.	**COOLANT/LUBRICATION**		
a	Coolant tank Capacity	Litres	100 or higher
b	Coolant pump motor	kW	0. 37
c	Coolant pump output	lpm	20 or higher
d	Lubrication type		Automatic centralized lubrication
e	Lubrication tank capacity	Litres	3 or higher
8.	**AIR COMPRESSOR FOR TOOL UNCLAMP**		
a	Compressor Type		Screw type with dryer, filter & air receiver
b	Tank capacity	litres	200 or higher
c	Air Flow	CFM	10 or higher
d	Pressure	bar	7 max.
9.	**POWER SOURCE**		
a	Mains supply (± 10 %)		415 V, 3 Ph. , 50Hz
b	Total connected load requirement		Approx. 15 kVA
10.	**STANDARD EQUIPMENT**		
a	Voltage Stabilizer	15 kVA	
b	Air conditioning unit for electrical cabinet	1 no.	
c	Backup CD for PLC Ladder Logic	1 no.	
d	Machine lightning	1 no.	
e	Levelling pads and jacking screws	4 nos.	
f	Operation manual	1 no.	
g	Maintenance manual	1 no.	
h	Installation kit	1 no.	
i	Maintenance tool kit	1 no.	
j	6 rack tool trolley (Size 25"x22"x45") with lock	1 no.	
h	Machine guarding with safety compliance	1 no.	
11.	**MAKES OF CRITICAL COMPONENTS**		
a	LM Guideways	HIWIN/THK/PMI/STAR	
b	Ball Screws	HIWIN/THK/TSUBAKI/PMI/STAR/HMT/NSK	
c	Spindle Bearings	RHP/NSK/FAG/SKF/NRB	
d	ATC	PRAGATI/GIFU	

e	Panel AC	WERNER FINLEY/RITTAL/LEXTECNOID
f	Stabilizer	NEEL/SE RVOMAX/CONSUL/FARMAX
g	Lubrication	CENLUBE/DROPCO
h	Coolant Pump	RAJAMANE/GRU NDFOS
i	Cutting tools and holders	SANDVIK/TAEGUTEC/KEN NAMETAL/SECO/MITSUBISHI
j	Air compressor (capacity: 6 kg/cm2 - 300 lpm min.)	GODREJ/ELGI/KAESER/ATLASCOPCO

12.	**Cutting Tools & Tool Holders (for BT30 or BT40 as per machine supplied)**					
S No.	**Item**	**Quantity**		**Inserts**	**Quantity**	
		1 year	**3 years**		**1 year**	**3yrs**
a.	Face mill 45 degree 63 mm. , insert type	2	4	Suitable inserts	5 sets	15
b.	Face mill square shoulder 50 mm. , insert type	2	4	Suitable inserts	5 sets	15
c.	Twist drill HSS straight shank 6, 6. 7, 8. 5, 9. 7	2	4		20	60
d.	Spot drill Carbide, dia. 8 mm X 90°	2	4		20	60
e.	Drill insert type - 16 mm	2	4	Suitable inserts	10	30
f.	Solid carbide Twist drill straight shank - 8 mm	2	4			
g.	Solid carbide End mill straight shank - 10, 12 mm dia.	2	4			
h.	End mill insert type straight shank - 16 mm dia.	2	4	Suitable inserts	10	30
i.	Machine Taps HSS - M8, M10	2	4		10	30
j.	Solid carbide Reamer straight shank - 10 mm	2	4		10	30
k.	Finish boring bar dia. 20 to 25 mm	1	3	Suitable inserts	10	30
l.	Holder for face mills (Adapter)	2	4		20	60
m.	Collets for above drills, reamers, end mills	2 sets	4 sets			
n.	Collet holder suitable for collets	4	4			
o.	Side lock holder for 16 mm insert drill	1	2			
p.	Machine vice 0-150 mm range - Mechanical type	1	1			
q.	C spanner for tightening tools in holder	1	2			
r.	Magnetic dial stand	1	2			
s.	Mallet	2	4			
t.	Tap wrench	1	2			
u.	Hands tools set (spanners, Allen keys, etc.)	1 box				
v.	T Nuts, Strap clamps, Clamping Nuts and studs	1 set				
w.	Hands tools set (spanners, Allen keys, etc.)	1 box				
x.	T Nuts, Strap clamps, Clamping Nuts and studs	1 set				


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